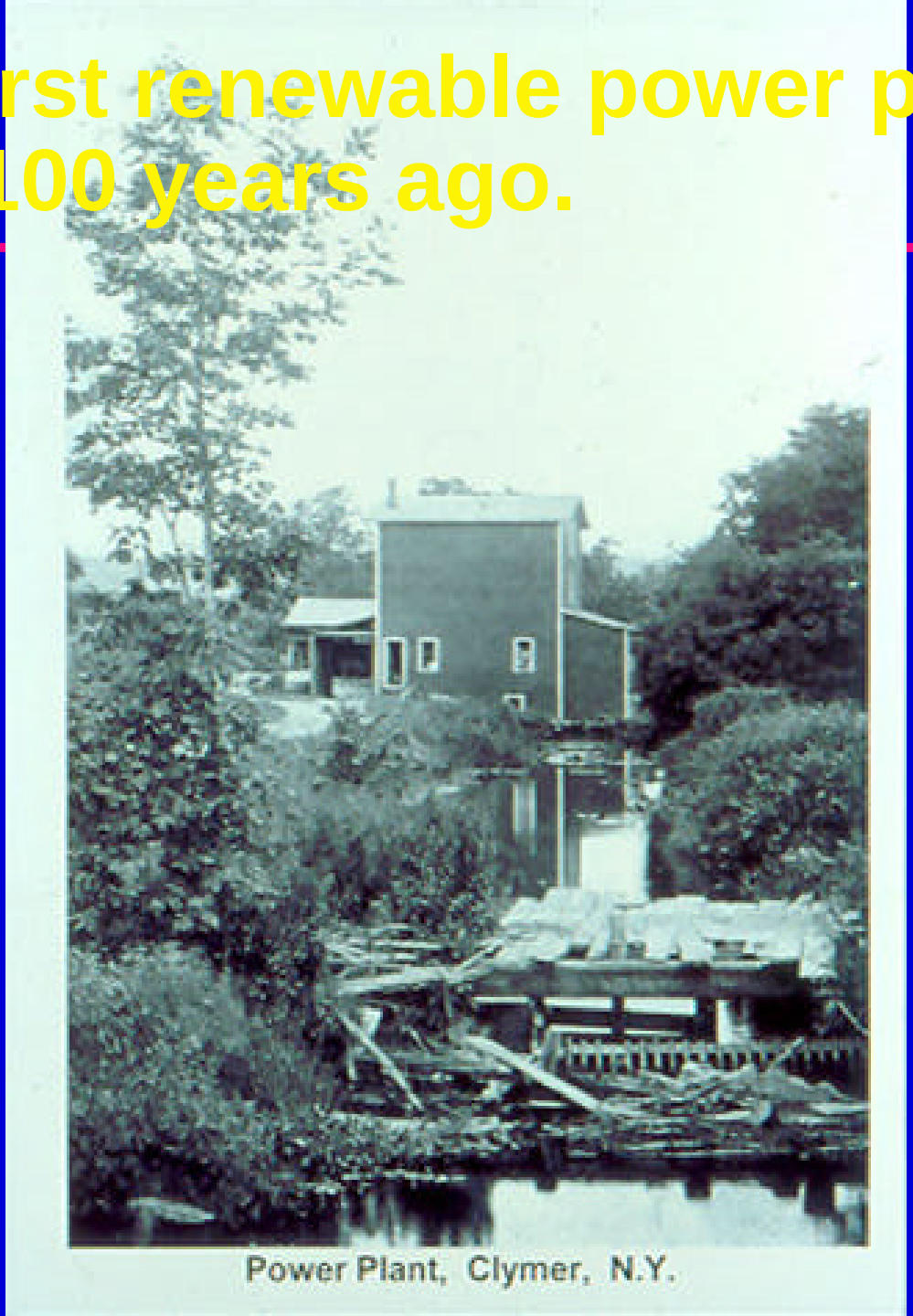
Case Study Co-digestion

Ted Mathews

Matlink Farms

Clymer, New York

The first renewable power plant built 100 years ago.



Power Plant, Clymer, N.Y.

This is the second renewable power plant in Clymer

The town is down wind odor control is a must!

We farm close to 55% of the town aquifer.

We received a grant from NYSERDA to build a mix digester

How it works and where it goes.

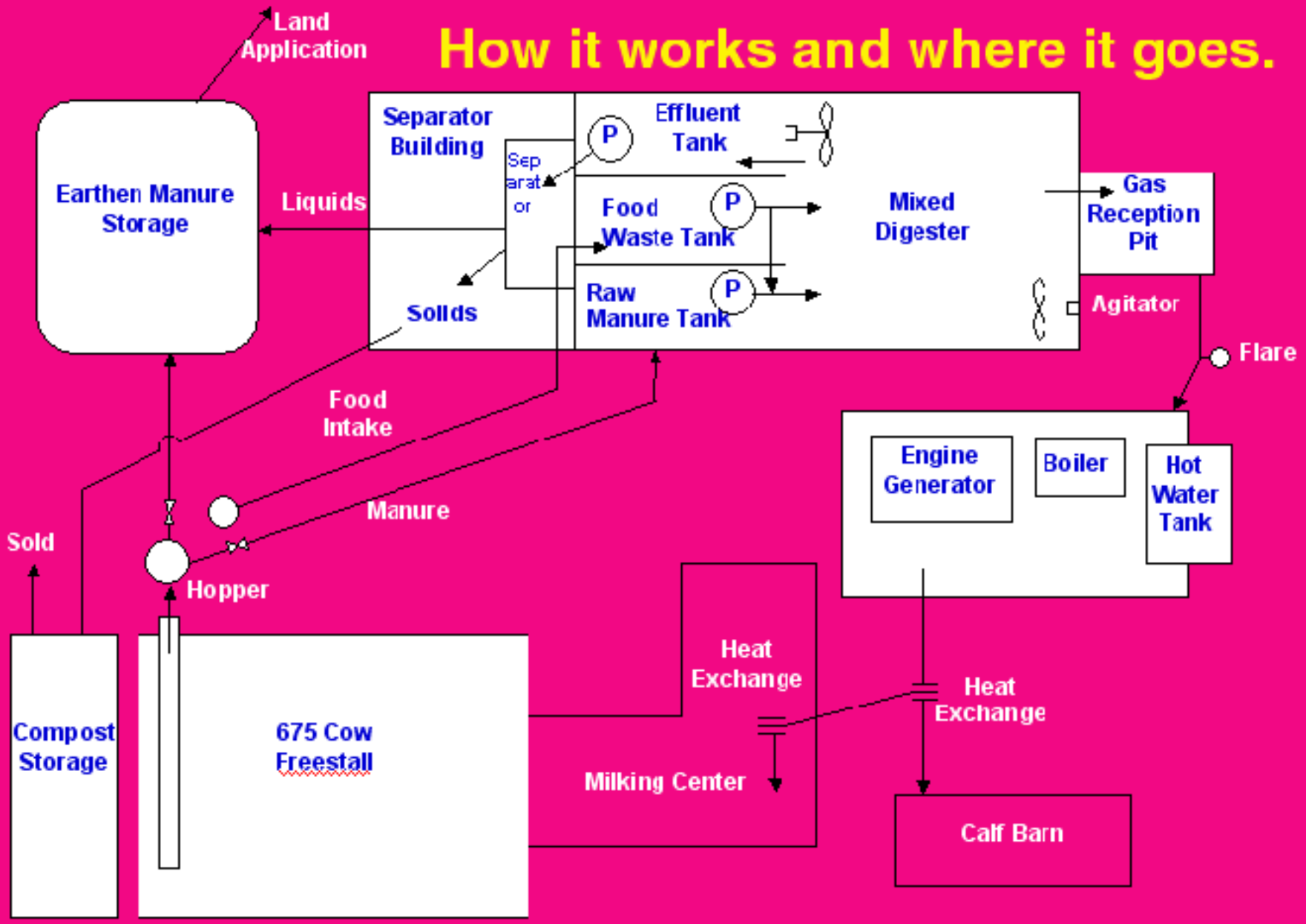


Figure 1. Schematic of Anaerobic Digester System on Matlink Dairy Farm (not to scale).

Fully insulated 6 row free stall barn

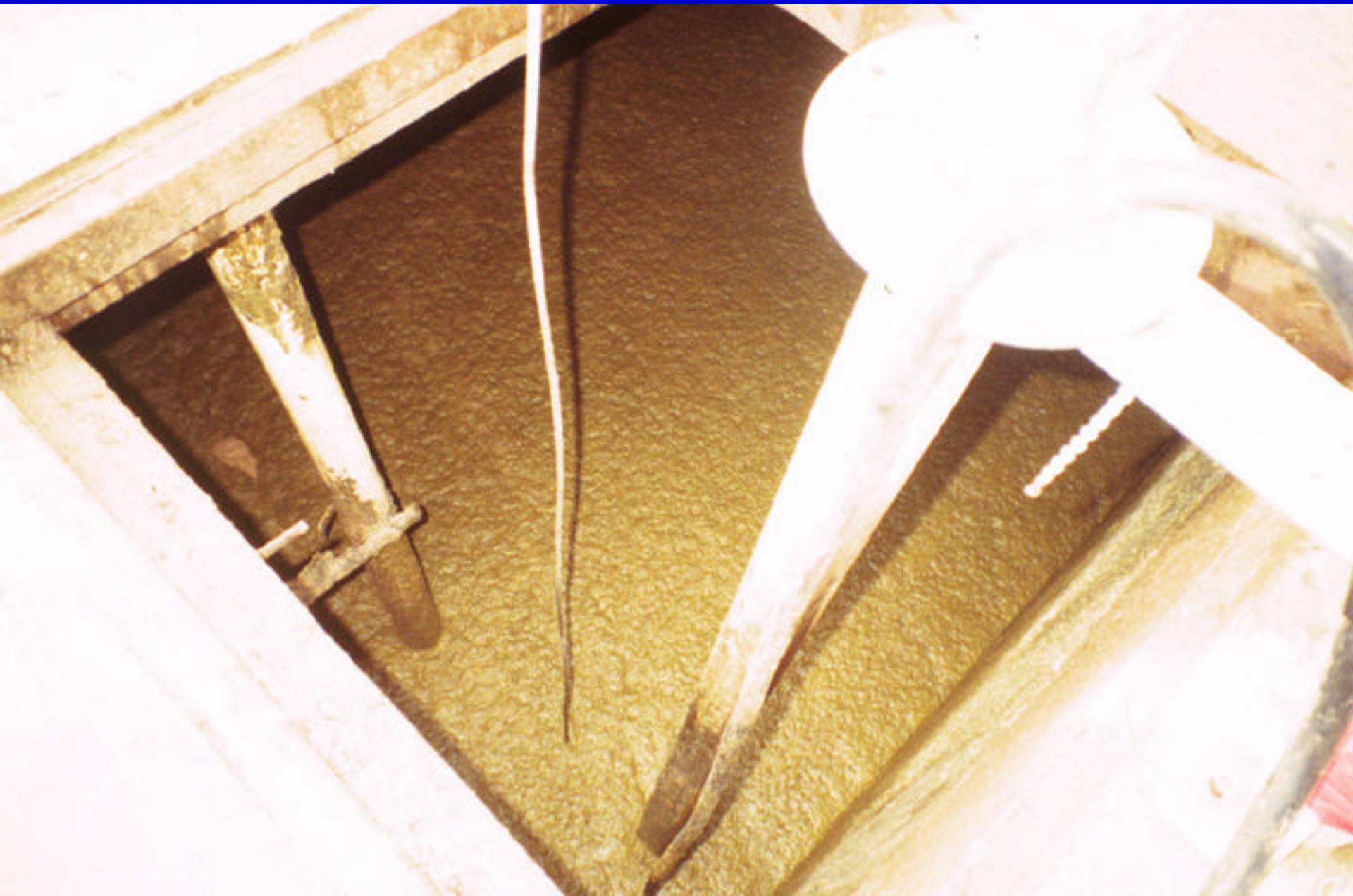
Along with the manure we are processing liquid food wastes from 4 sources.

Open house photo.

Prep. tanks

Chopper pumps and hoists

View of food tank



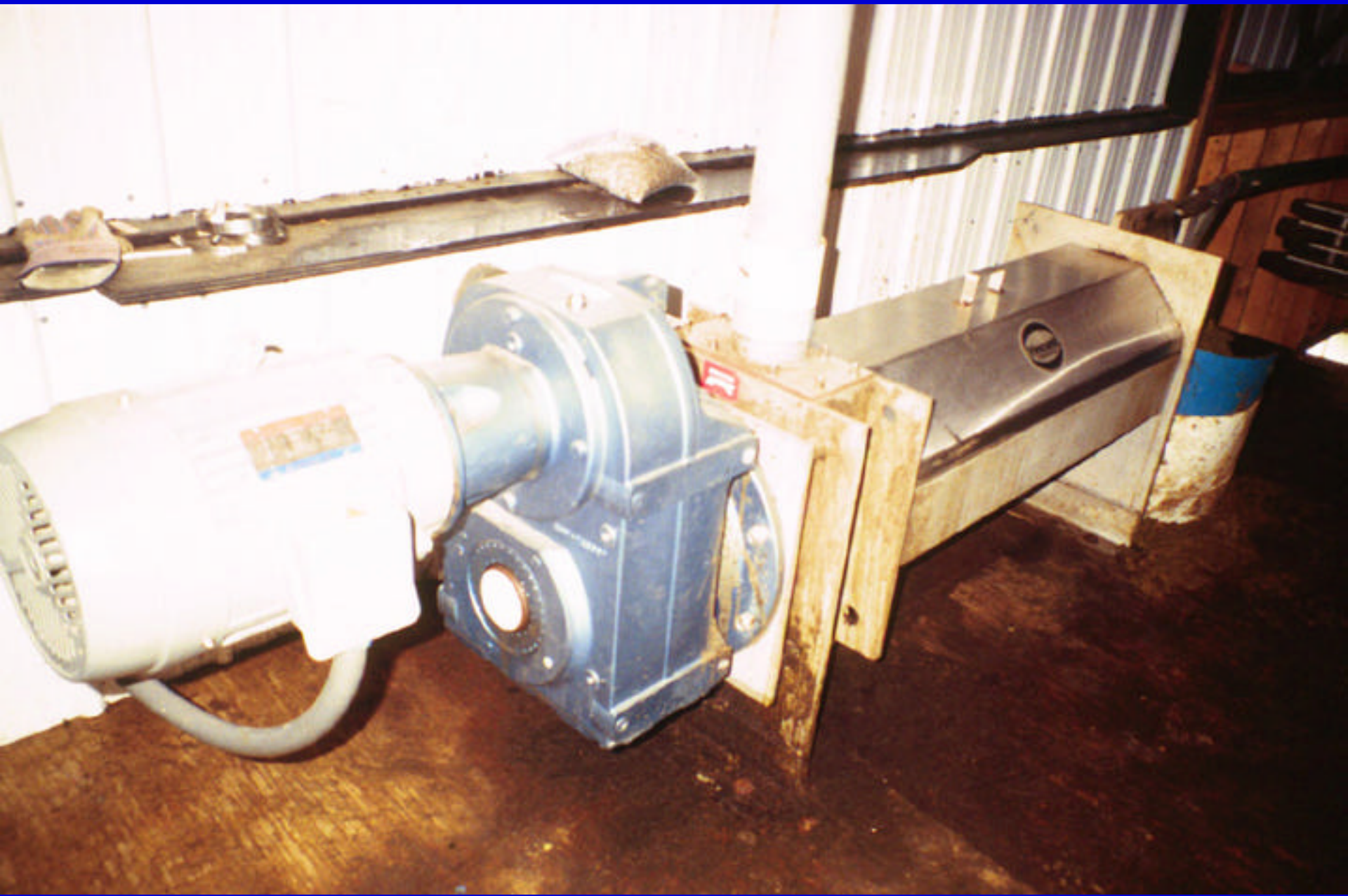
View of manure tank

Bag/Engine Building

Beam that hold the bags in the middle.

Weir where effluent exits the digester (notice the foam)

Vincent KP 10 separator



As solids got finer we needed more pressure on the press plate

The screen

Age solids before using for bedding

Solids on their way to barn

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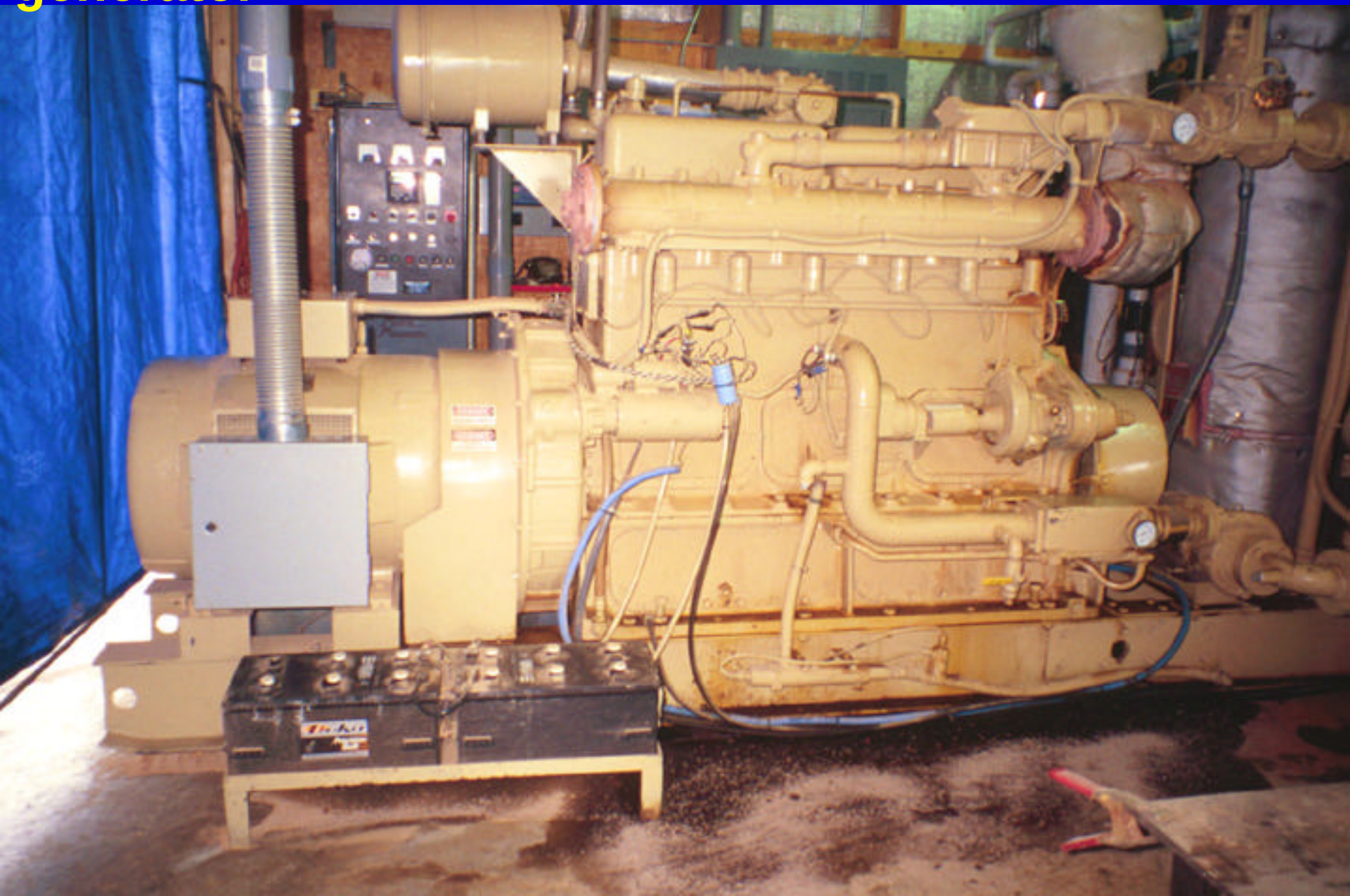
Lagoon

Back to the field

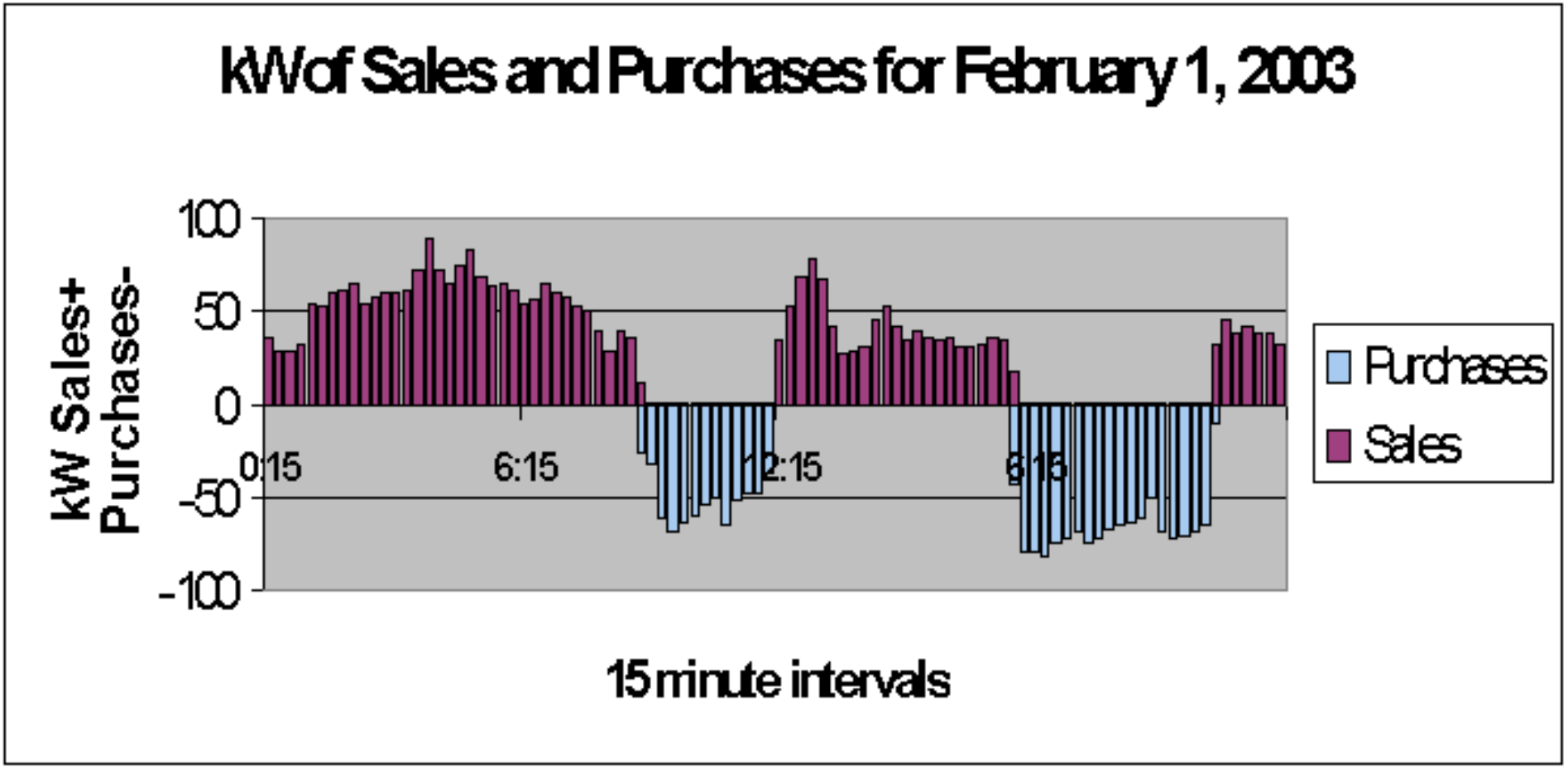
Generator building is uphill from the digester.

1905 Waukesha powering 145KW Marathon generator



Gencon and Switzer box.

Energy check



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How will the energy be used?

The Resource Recovery Center- NYSERDA funding

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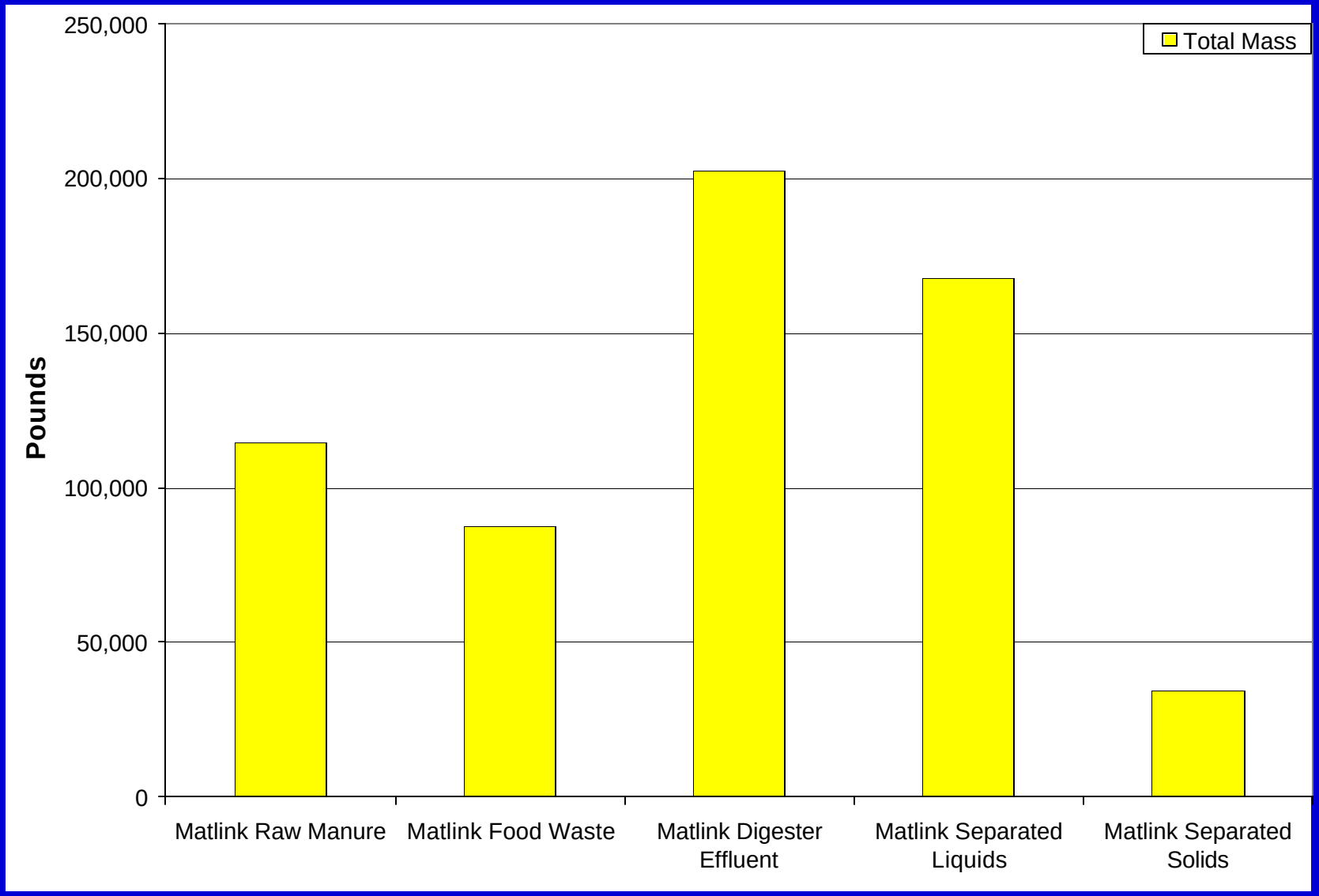
7,000,000 BTU dryer

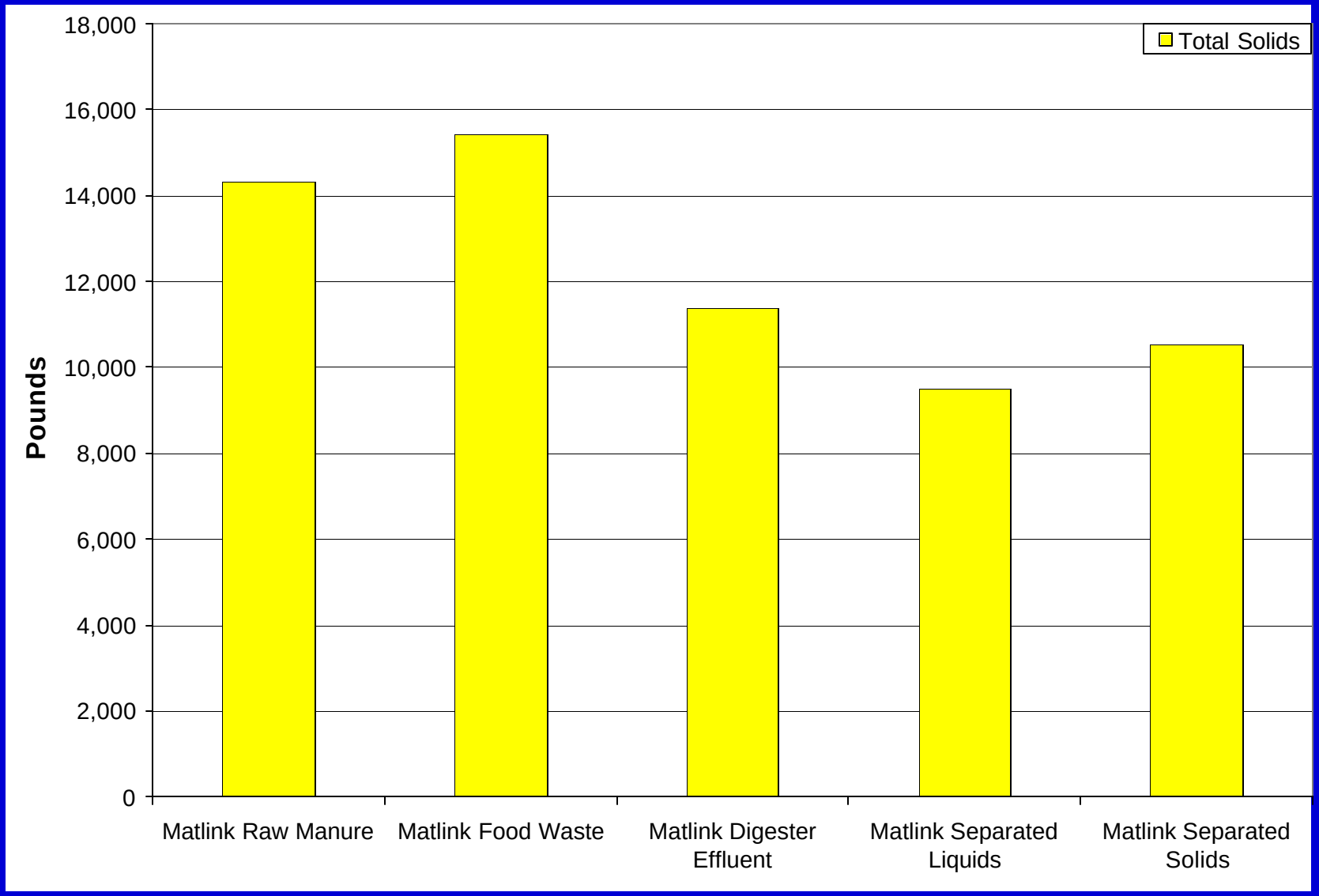
Inside the dryer

Dual fuel train

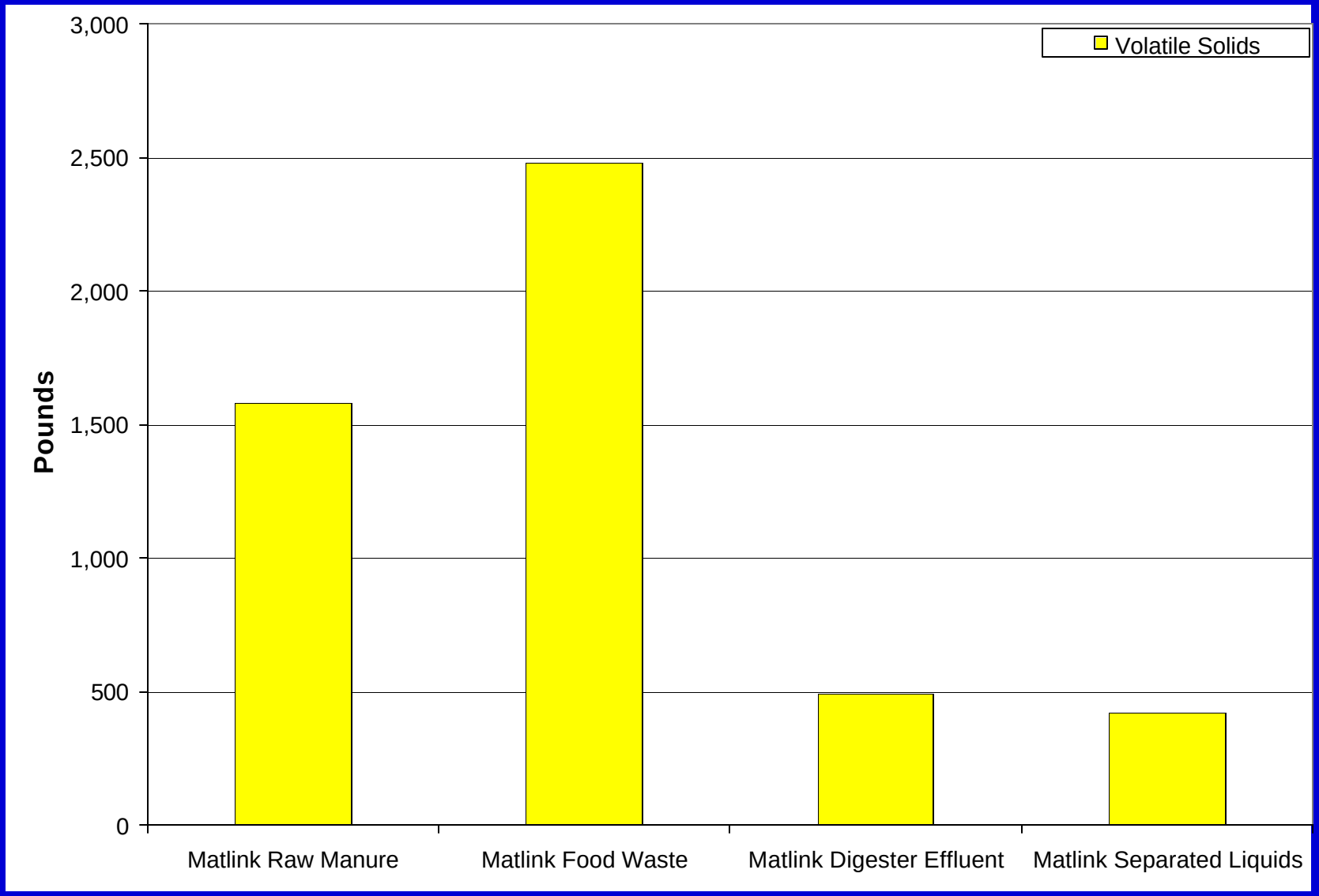
Total Mass


Total Mass
Pounds
250,000
200,000
150,000
100,000
50,000
0
Matlink Raw Manure
Matlink Food Waste
Matlink Digester Effluent
Matlink Separated Liquids
Matlink Separated Solids

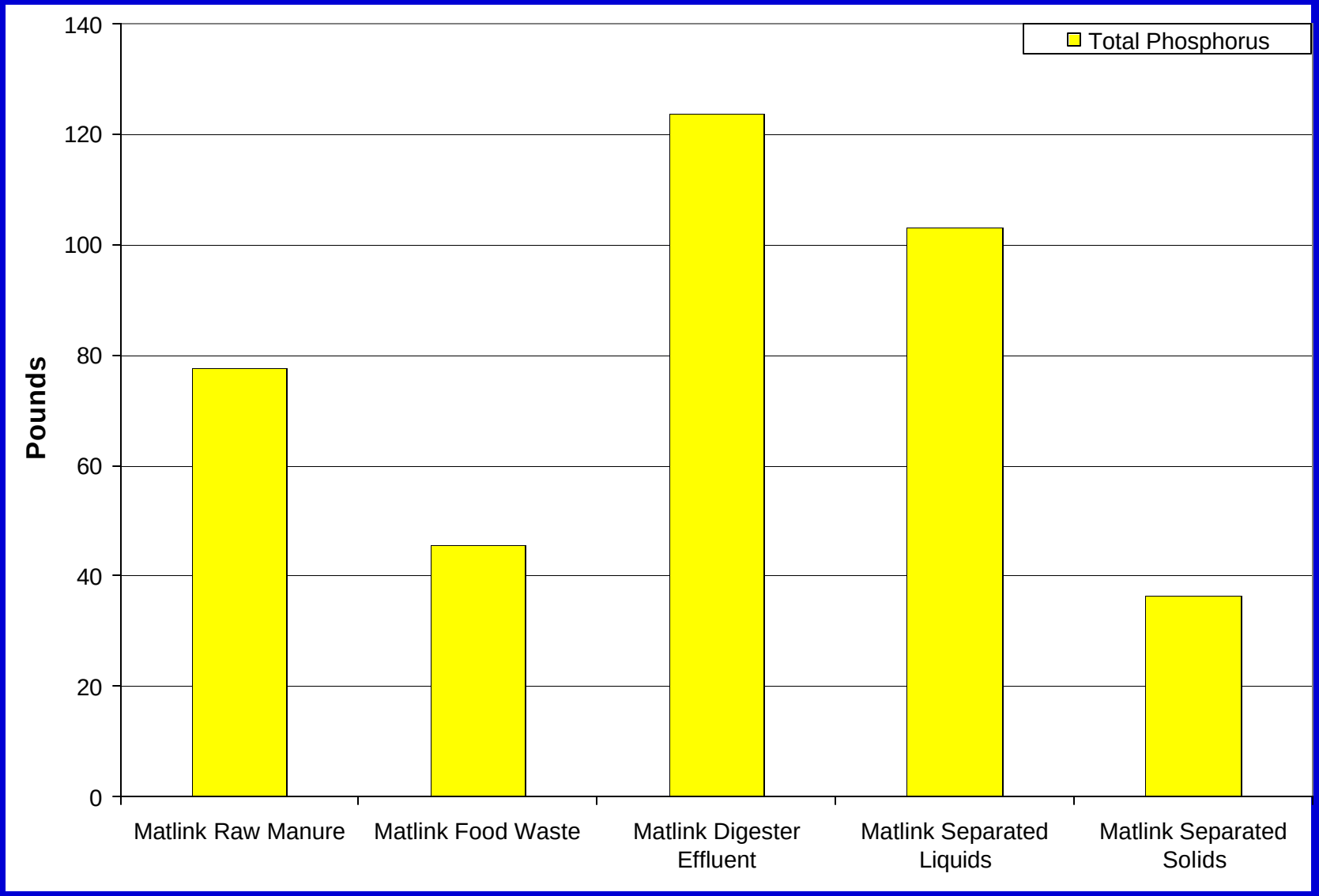
Total Solids



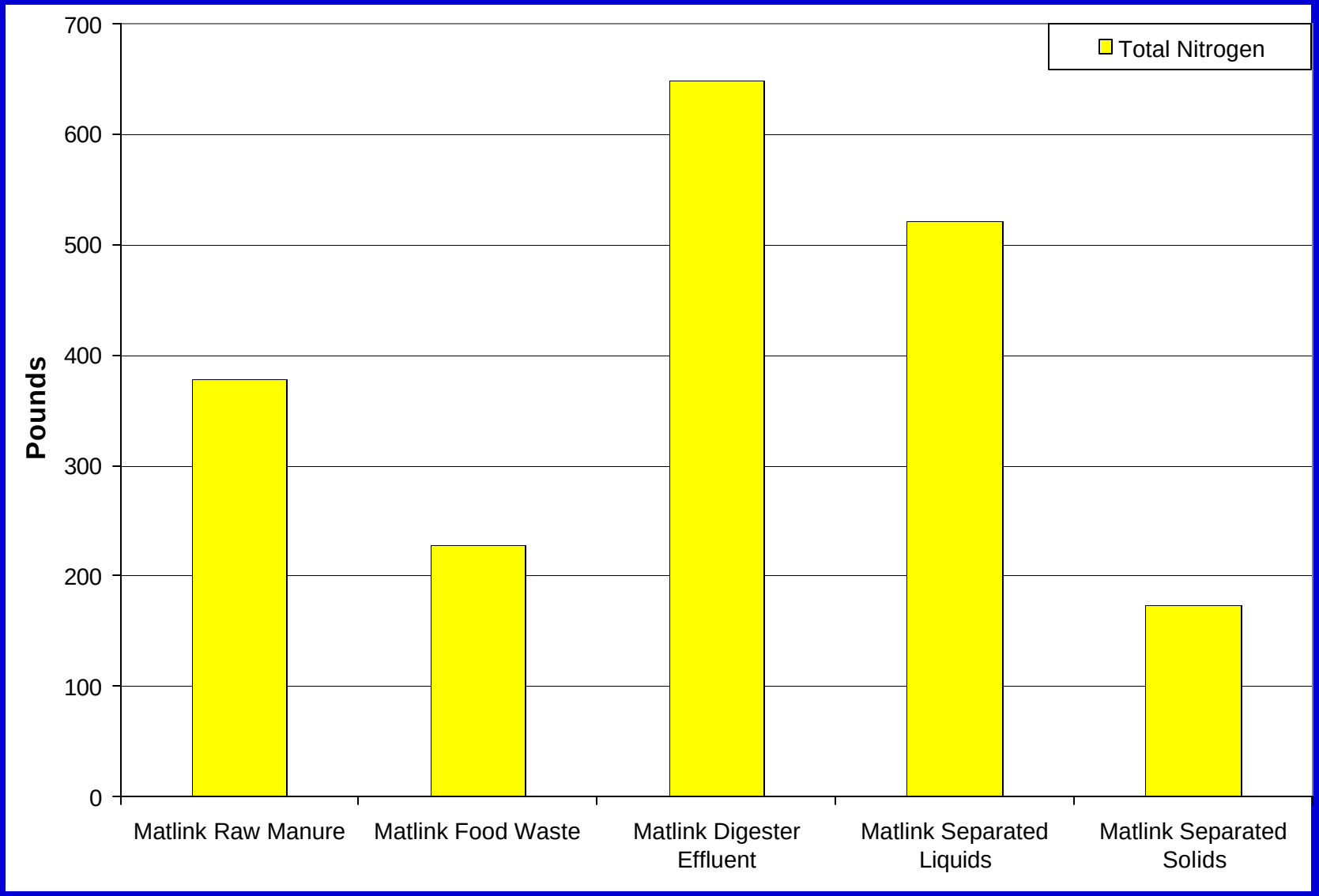
Total Volatile Solids



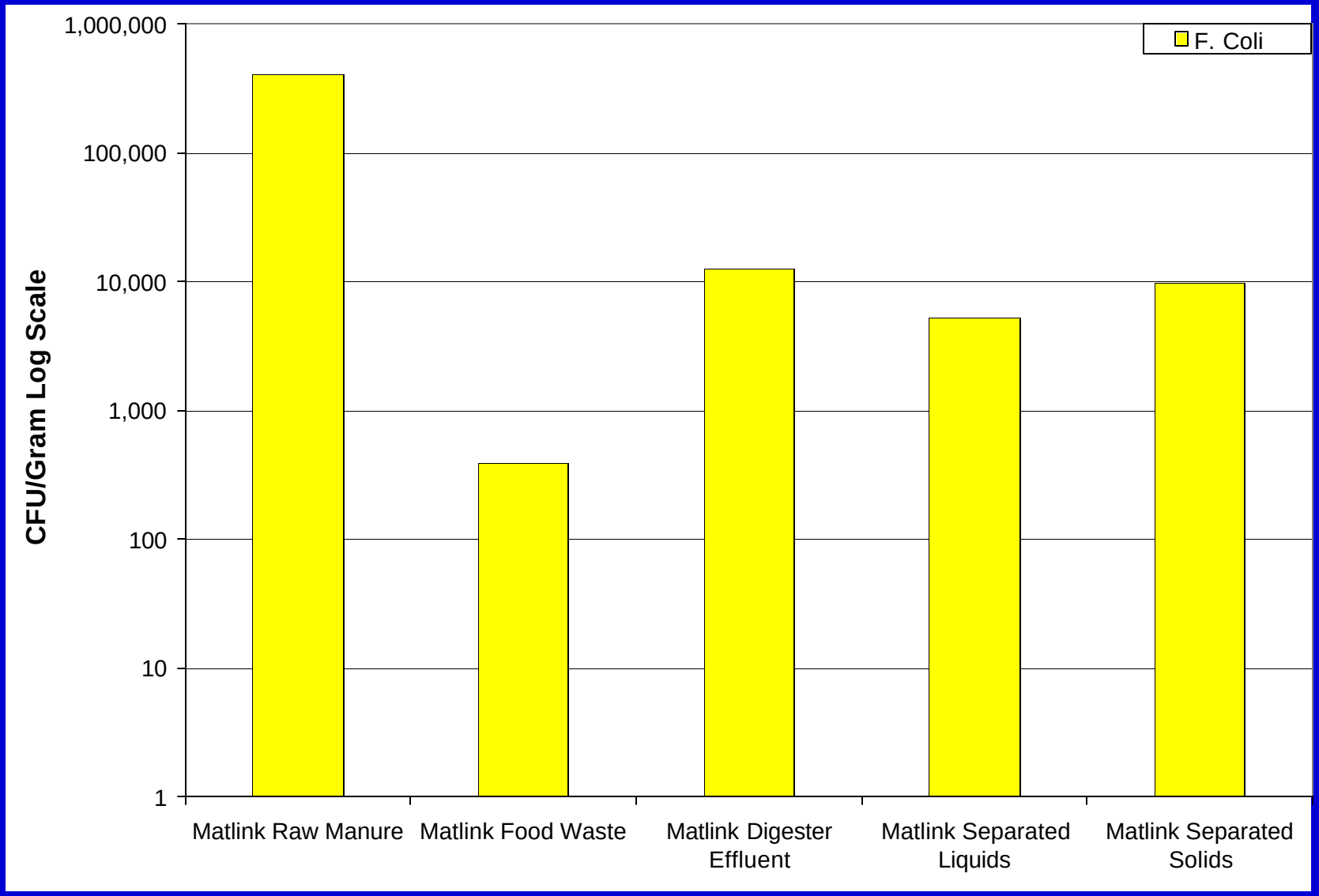
Total Phosphorus



Total Nitrogen



Fecal Coliform



Economic Costs and Benefits

	Items	Costs/Benefits
Capital Costs	Digester	
	- Digester Construction and Materials	$260,000
	- Mixture Pumps	$77,000
	Subtotal	330,000
	Engine-Generator Set	
	- Engine Generator	$96,317
	- Switching Equipment	$10,000
	- Engine Building	$22,614
	Subtotal	$128,931
	Solids and Liquids Separation	
	- Separator	$46,613
	- Separator Building	$15,076
	Subtotal	$61,689
	Liquid Storage	$45,000
	Others	$56,900
	Total Capital Cost	$622,520
	Total Annual Capital Cost	$61,232
Annual Operating Costs	Maintenance, Repairs, Labor, Fuel, Insurance, Reporting, Water treatment, Spreading Costs, etc,	$115,910
Annual Benefits Including	Electricity savings, Tipping fee for handling food wastes, Bedding material replacement, Compost sales, Hot Water (heat), and Odor Control	
	Total Annual Benefits	$292,785
Annual Income Per Cow ($/cow/year)		$171

Capital Costs

▪ Digester	$330,000
Digester Construction and Materials-	$260,000
Mixer and Pumps	$77,000
▪ Engine-Generator Set	$128,931
Engine Generator	$96,317
Switching Equipment	$10,000
Engine Building	$22,614

Capital Costs Continued

▪ Solids and Liquids Separation	$61,689
Separator	$46,613
Separator Building	$15,076
▪ Liquid Storage	$45,000
▪ Others	$56,900
▪ Total Capital Cost	$622,520
▪ Total Annual Capital Cost	$61,232

Annual Costs

- Maintenance, insurance, and repairs $20,663
- Reporting food waste to regulators $500
- Water treatment for heat exchange system $800
- Spreading costs tractor tank wagon and irrigation $93,947

- Total annual operating cost $115,910

Benefits

- Electric sales off farm $12,000
- Tipping fee for handling food wastes $210,000
- Bedding material replacement, separated, partially composted (2 weeks) used as bedding $15,600
- Compost sales, potential markets still being developed $6,000
- Hot water, heat recovered from the engine used in calf barn and milking center $6,000
- Odor control, avoided cost of additives and management time to resolve complaints $5,100
- Gas sales to drying operation $100,000
- Total annual benefits $392,785

Matlink Manure System Economics

- Total Annual Benefits $392,785
- Total Annual Capital Cost $61,232
- Total Annual Operating Cost $115,910

- Net Annual Income From Manure $215,643

- $320/cow per year

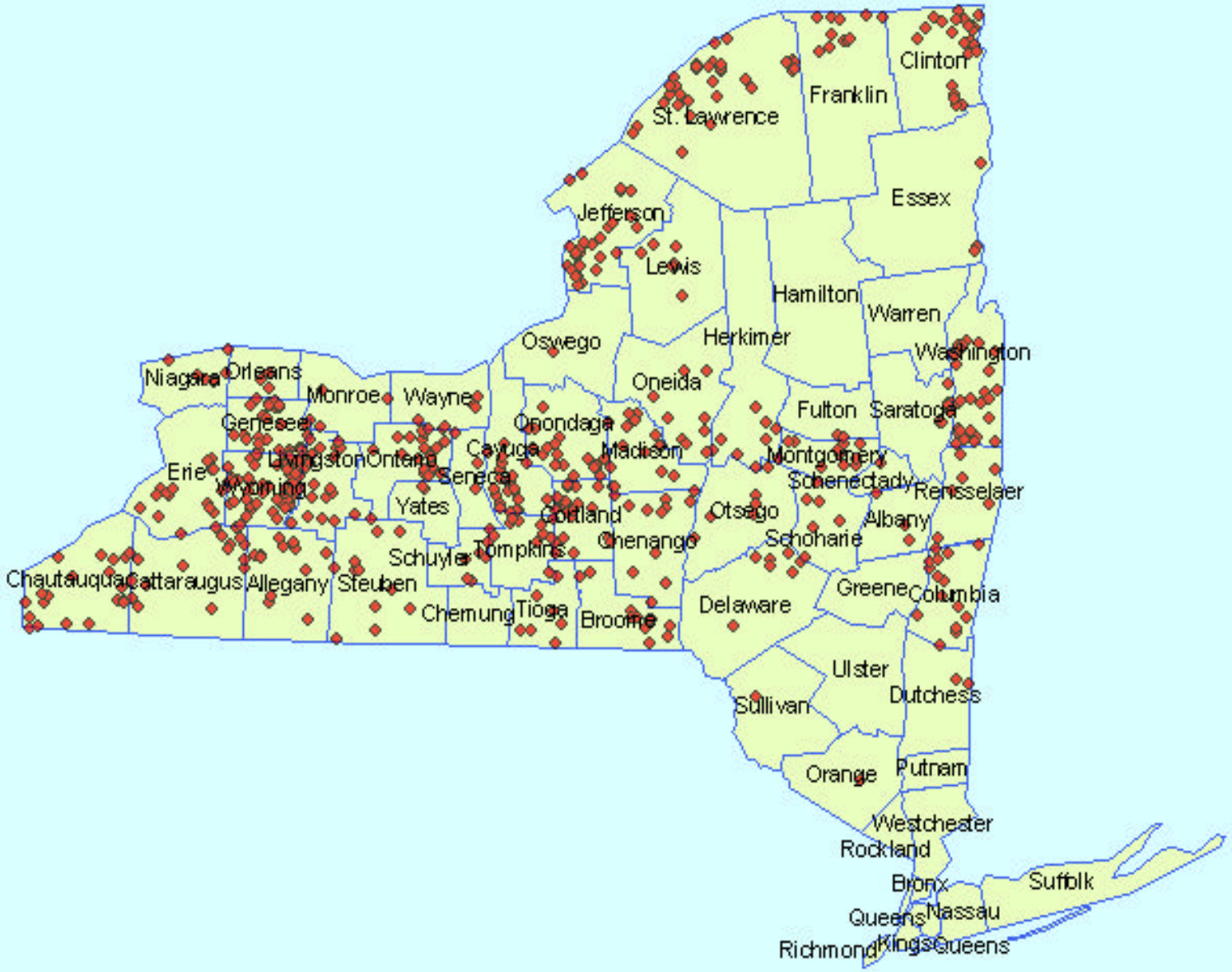
Benefits

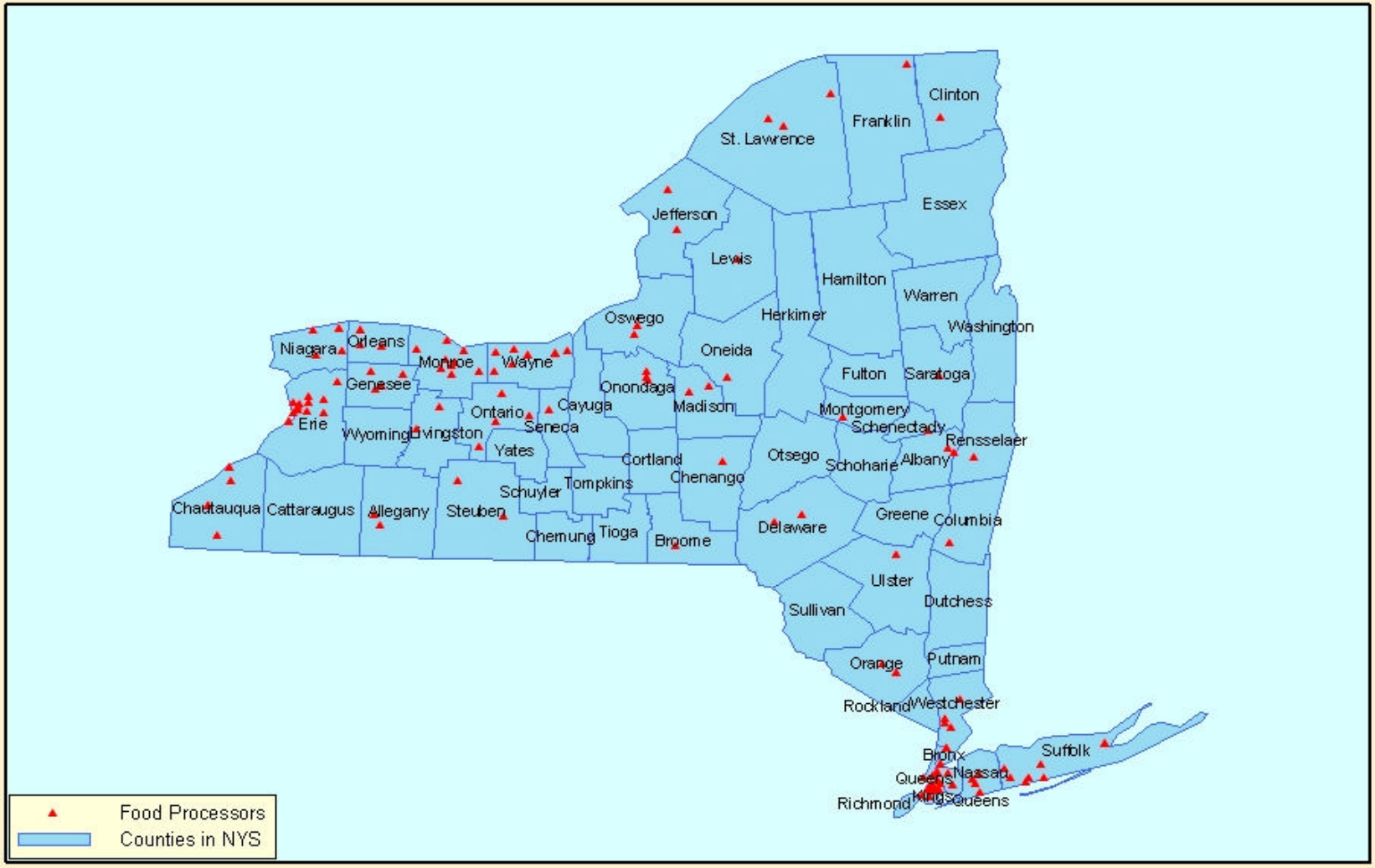
- Energy production
- Odor Reduction
  - Nutrient Management
- Solid Sales
  - Bedding use
- Liquefy Manure
- Integration with other enterprises

- Profit Center

Food waste benefits

- Profits from tipping fees
- More energy
- Small nutrient increase
- Heated waste
- Pays for odor control
- Pays for pathogen reduction
- Liquefies the manure stream
- Reduction of solids


Clinton
Franklin
St. Lawrence
Essex
Jefferson
Lewis
Hamilton
Warren
Washington
Herkimer
Oswego
Oneida
Niagara
Orleans
Monroe
Wayne
Fulton
Saratoga
Genesee
Onondaga
Cayuga
Madison
Montgomery
Erie
Wyoming
Livingston
Ontario
Seneca
Schenectady
Rensselaer
Yates
Cortland
Otsego
Albany
Chenango
Schoharie
Tompkins
Schuyler
Chautauqua
Cattaraugus
Allegany
Steuben
Chemung
Tioga
Broome
Delaware
Greene
Columbia
Ulster
Sullivan
Dutchess
Orange
Putnam
Westchester
Rockland
Bronx
Suffolk
Nassau
Queens
Kings
Queens
Richmond



Relatively Large-Scale and Concentrated Food Waste Generating Sources in New York

Jianguo Ma, Norman Scott
Cornell University
September, 2003

0 20 40 Miles

Supported by NYSERDA.

Food Waste Disadvantages

- Foam
- Too much gas
- Potential contamination
- Regulatory constraints

Management Problems

- Excess Energy
- Vandalized
- Foam
- Fire
- Beam failure

Foam exiting the mixer chase

Pipe and mixer chase

Close enough

The gas needs to keep moving

Almost fixed

Conclusions:

- Management needs to be dedicated to the system
- Alternative Systems depend on farm situation
- Maximize By-Product Use
  Maximize Profits
- Integrate with other enterprises

Questions?